PLENARY SESSIONS

These sessions covered five areas: volcanic ash encounters; volcanic ash source; ash cloud observation, modeling, and forecasting; Volcanic Ash Advisory Center (VAAC) operations and capabilities; and aviation industry perspectives. The sessions consisted of both oral and poster presentations from the international community and set the stage for related breakout sessions. Papers for some presentations can be found in Appendix C.

Session 1: Encounters, Damage, and Socioeconomic Consequences

Session Chairs: Mr. Edward Miller, *Air Line Pilots Association*
Mr. Leonard Salinas, *United Airlines*

Rapporteur: Mr. Donald Carver, *Federal Aviation Administration (FAA)*

This session featured six oral and two poster presentations focused on aircraft encounters with volcanic ash and the impacts of volcanic ash on airline operations. Aircraft encounters with Montserrat, Mt. Hekla, Rabaul, and Miyakejima were described, as well as how the volcanic ash hazard impacts the operations of airlines such as United Airlines and Air Niugini. The fact that ash can reach commercial flight levels within minutes and that even apparent diffuse ash can cause significant engine damage highlighted the need for early detection and warning.

Session 2: The Volcanic Ash Source - Eruption Monitoring and Reporting

Session Chairs: Ms. Marianne Guffanti, *United States Geological Survey (USGS)*
Dr. Steven McNutt, *Geophysical Institute, University of Alaska and the International Association of Volcanology and Chemistry of the Earth's Interior*

Rapporteur: Ms. Terry Keith, *USGS*

This session featured eight oral and 13 poster presentations focused on eruption monitoring and reporting. The first oral presentation provided a global perspective on volcanoes and their eruptions and noted that many of the world's active volcanoes are in developing countries and that monitoring these volcanoes is difficult. Several of the presentations noted the difficulty in monitoring volcanoes and in determining the timing and strength of potential eruptions. There were also presentations on current capabilities for monitoring volcanic eruptions in the North Pacific and in the Western Pacific. Other initiatives such as a prototype infrasound system; an alert-level notification scheme for aviation, using volcanic tremors in estimating eruption parameters; and ground-based detection of ash and sulphur dioxide were presented as well. Points emerging from this session included the need for instrumenting more volcanoes that pose a threat to aviation, the need for more research on volcanic processes and ash cloud characterization, and the need for a standardized warning system.

Session 3: Ash Cloud Observations, Modeling, and Forecasting

Session Chairs: Dr. William Rose, *Michigan Technological University (MTU)*
Ms. Barbara Stunder, *NOAA Air Resources Laboratory*
Mr. Andrew Tupper, *Bureau of Meteorology, Volcanic Ash Advisory Centre, Darwin, Australia*

Rapporteur: Ms. Alexandria Matiella, *MTU*

This session featured eight oral and 22 poster presentations focusing on ash cloud observations and forecasting ash cloud movements, using volcanic ash transport and dispersion models. Several different transport and dispersion models including VAFTAD, CANERM, HYSPLIT, and PUFF were presented. Various techniques for detecting volcanic ash clouds, using satellite and radar, were also presented. It was also noted that use of various satellite techniques provide valuable information on the wet and dry processes that remove ash particles. Speakers agreed that difficulties in knowing the ash plume parameters and the meteorology often cause uncertainties in the models.

Session 4: Volcanic Ash Advisory Center (VAAC) Operations and Capabilities

Session Chairs: Ms. Grace Swanson, *NOAA National Environmental Satellite, Data, and Information Service, Volcanic Ash Advisory Center, Washington, D.C.*
Mr. Rene Servranckx, *Environment Canada, Canadian Meteorological Center, Volcanic Ash Advisory Centre, Montreal, Canada*

Rapporteur: Mr. Donald Carver, *FAA*

This session featured ten oral and seven poster presentations focusing on various aspects of VAAC operations. Two papers highlighted the roles of the ICAO and the World Meteorological Organization (WMO) in dealing with the volcanic ash threat. Several papers provided operational capabilities at several VAACs, including the Washington VAAC, the Tokyo VAAC, the Montreal VAAC, the London VAAC, and the Darwin VAAC. The importance of shared situational awareness and collaboration were stressed in several papers, and the capabilities of a new pilot program called the Volcanic Ash Collaboration Tool were highlighted as a possible way to enhance collaboration among international agencies.

Session 5: Aviation Industry Perspectives

Session Chairs: Mr. Steven Albersheim, *FAA*
Mr. John Murray, *National Aeronautics and Space Administration/Langley Research Center*

Rapporteur: Mr. Floyd Hauth, *Science and Technology Corporation*

This session featured seven oral and one poster presentations focusing on the volcanic ash threat from the perspective of the aviation industry. Highlighted areas dealt with the transfer of R&D to operations, how volcanic ash impacts airport operations, and the impact of volcanic ash on air traffic control. The importance of the timely dissemination of volcanic ash information was stressed and a conceptual framework for streamlining the flow of information was provided.

Plenary Sessions Summary

Two themes that emerged from the plenary sessions were better communications and more education/training. Specific actions included:

- Improve communications to move data and information between all entities.
- Increase post-encounter investigations for development of better procedures and services.
- Provide airline pilots with more training with emphasis on hazard awareness.
- Increase the number of potentially hazardous volcanoes that are monitored by ground geophysical instruments.
- Perform more research on ash cloud characteristics to better define the hazard for dispersion models.
- Perform more research on fundamental volcanic processes that lead to "eruptions" versus "failed eruptions." This will help provide improved forecasts on the type, size, and duration of the eruption column as well as the end of the eruption.
- Obtain adequate funding to ensure that all potentially active volcanoes in the U.S. are instrumented and monitored.
- Standardize formats in alert messages.
- Optimize current satellite sensors for ash detection (atmospheric corrections, e.g., SO_2).
- Provide users more information in the pilot report (PIREP), in addition to a broader transmission of all reports in real time.